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ABSTRACT

This instructional unit is one of 10 developed by students on various energy-related areas that deals specifically with weatherizing a structure. Its objective is for the student to be able to analyze factors related to specific structures that indicate need for weatherizing activities and to determine steps to correct defects in structures that contribute to energy losses. Some topics covered are air movement, moisture content, and controlling low relative humidity and excess moisture. Material in each unit may include some or all of the following: terminal and specific objectives, list of references, information sheet with terms and definitions, informative materials, transparency masters, assignment sheet(s), and unit test with answers. (YLB)

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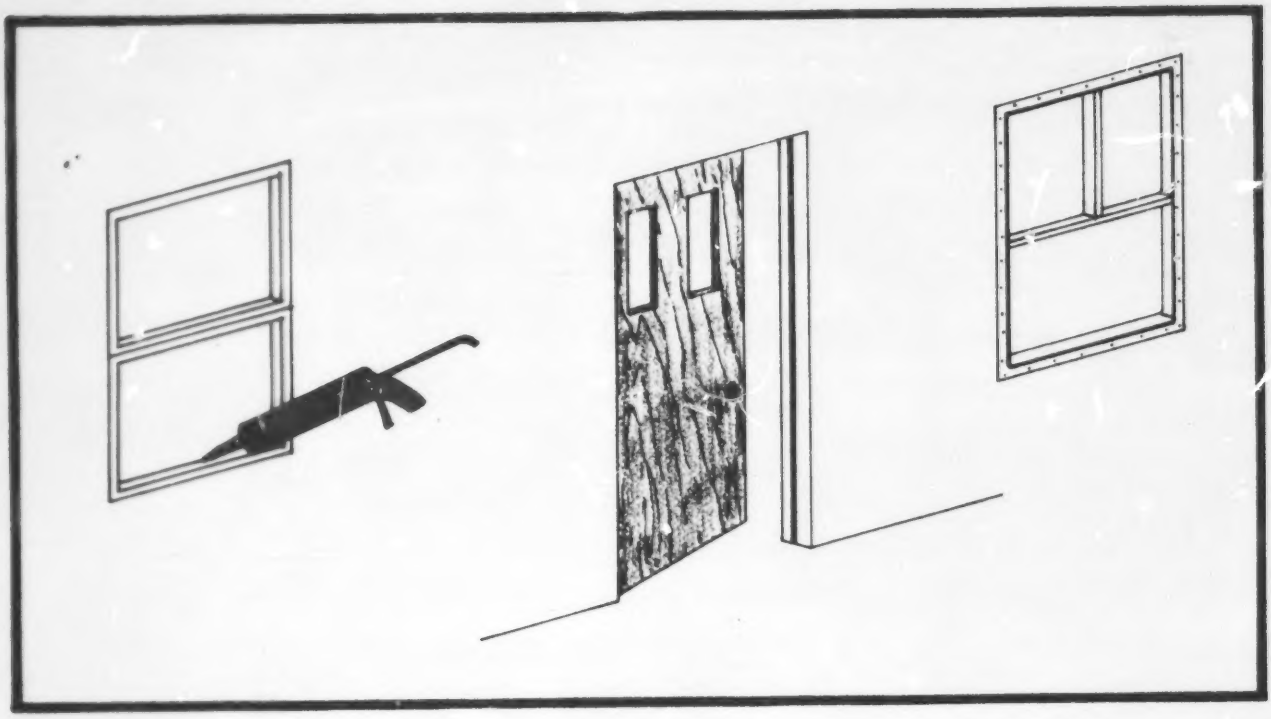
WEATHERIZING A STRUCTURE



by

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WEATHERIZING A STRUCTURE

TERMINAL OBJECTIVE

Upon completion of this unit the student should be able to analyze factors related to specific structures that indicate need for weatherizing activities. The student will be able to determine steps to take to correct defects in structure that contribute to energy losses. Proficiency will be evidenced by completion of assignments and exhibiting a recommended 85% accuracy on unit test.

SPECIFIC OBJECTIVES

After completion, the student will be able to:

1. Select factual information from non-factual information of a general nature concerning weatherization.
2. Select and match terms pertaining to weatherization from a list of related definitions.
3. Identify in writing two factors related to importance of keeping insulation dry.
4. State four points to keep in mind in controlling air filtration.
5. Explain in written form the importance of structural paint job as it relates to weatherization.
6. Describe, in order, the techniques used in applying weather stripping to storm doors.
7. Outline, in written form, the method used to install temporary weatherization of fixed windows.

WEATHERIZING A STRUCTURE

INFORMATION SHEET

I. Terms & Definitions

A. Caulking -- to stop up (cracks of window frames, pipes, etc.) with a filler.

B. Condensation -- the changing of water in vapor form to liquid state. Frequently occurs on window glass.

C. Humidistat -- device attached to humidifer to automatically control amount of humidity in air.

D. Relative Humidity -- the amount of moisture in the air at a fixed volume and temperature divided by the absolute amount of moisture the air can hold at a fixed volume and temperature. Expressed as a percentage.

E. Sealant -- substance used to effectively close a joint, crack, or surface to prevent the flow of fluid, air, or air ladened particles.

F. Thermal door -- door compound of two layers of building material enclosing an insulating core.

G. Thermal window -- windows composed of 2 layers of glass enclosing vacuum which slows down heat escaping to the outside.

H. Vapor barrier -- material used to retard the flow of water vapor into wall cavities and thus preventing condensation within them.

I. Ventilation -- system by which air flow and circulation is achieved.

J. Weather-stripping -- thin strips of metal, felt, wood, etc., used to cover the joint between a door or window sash and the jamb, casing or sill, so as to keep out drafts, rain, etc.

WEATHERIZING A STRUCTURE

There are several structural factors which indicate a need for weatherization. When considering weatherization, it is usually considered in terms of heat or cold loss or gain. There are steps that can be taken to correct defects that add to a loss of heating or cooling energy. Air movement and moisture content are two factors to be considered in energy losses.

Humidity is necessary to maintain a structure. The problems arise out of too little or too much moisture in the air. The ideal level is between 30% and 50% relative humidity. Relative humidity is the amount of moisture present in the air compared to the moisture the air is capable of holding at the same temperature.

There are several sources of moisture in a structure. There is the evaporation of water during cooking. Showers add ¼ - ½ pound of moisture to the air. Tub baths add about ¼ of that added by showers. The old wringer washer adds 4 pounds of moisture. The automatic washer releases only a small amount of moisture. On the other hand the clothes dryer puts about 26 pounds of moisture into the air. It is for this reason that the dryer should be vented to the outside. Do not vent into the crawl spaces or attics as this just throws the moisture into the house structure at a different point. These figures are based on a family of four. A family of four adds about 6 pounds of moisture a day through normal breathing.

The following signs are evidence that there is an excess moisture problem. These problems could be inside, outside or underneath the home. The roof could be blackened. This is caused by algae. The

wind carries the algae and deposits it on roofs. The algae do not seem to damage the roof. However, their presence could indicate damage to the attic. The paint could be peeling or blistering. This is caused by a vapor pressure build-up. It could be due to a lack of ventilation or to a poorly installed vapor barrier. Condensation is another sign of excess moisture. Condensation results from vapor changing back to a liquid state. It usually occurs on windows. But it can take place on walls and ceilings. Mildew and mold are a form of fungus. They can be found only in damp or moist places. A sign of excess moisture which is more obvious is a wet or damp crawl space. Look for damp earth, a damp foundation, condensation on the water pipes, mold on the ground or fungus on the lumber, or rotting wood. When ground water (water table) or standing water is within 18 feet of the crawl space as much as 19 gallons or 162 pounds of water may be added to the air.

Too little moisture causes problems, also. Furniture joints loosen and come apart as the wood shrinks and the glue dries out. The nap on rugs may become brittle. They will then wear out faster. Personal problems occur with a lack of moisture. Lips and eyelids become dried out. Dryness of the membranes in the nose and throat may occur. The skin becomes dry and flaky. Also, problems with static electricity buildup will increase.

Controlling Low Relative Humidity

A humidifier is the solution to low relative humidity. Both portable and permanent humidifiers are on the market. The consumer may get a directory of certified humidifiers. This directory is published by the Association of Home Appliance Manufacturers. It is

published quarterly. This directory lists more than 25 different brands of humidifiers. Each is certified as to its water output per 24 hours. A humidifier should always have a humidistat. The humidistat automatically controlls the amount of humidity in the air.

Controlling Excess Moisture

Excess moisture can be controlled. Ventilating fans are the best method to use in the kitchen and bathroom. A range hood with an exhaust fan should be used in the kitchen to get rid of excess moisture from cooking. The fans should be the blade-type or the squirrel-cage type. All fans should be exhausted to the outside. Do not exhaust to a crawl space or the attic. Warm moist air exhausted into the crawl space or the attic just increases moisture there. This could result in the rotting and decaying of the structural lumber. It also promotes the growth of fungus. A less effective substitute for the fans is an open window in the room where the excess is. A power roof ventilating fan controlled by a humidistat works well in the attic.

There are several methods to control water vapor. Installing storm windows and storm doors create dead air space acting as insulation. They prevent mold from forming thus preserving the area around the window. Storm sashes eliminate condensation on windows. They also help save energy and money on heating and cooling bills. To also save on energy bills and reduce condensation, add temporary plastic sheets. Use only heavy duty transparent plastic sheets. Attach it to the outside of the window facing. Attach with wood strips tacked every six inches. Attach the top first, pull tight to the bottom and do the sides last.

Water vapor in the air acts like heat. It moves from areas of high concentration to areas of low concentration. It moves from inside the building to the outside of the building. When the outside walls are not insulated and there is no vapor barrier, this warm moist air flows through the walls. No condensation occurs except on the windows. The reason for this is that the space inside the wall is warm due to rapid heat loss. When the wall is insulated but has no vapor barrier, the vapor penetrates the insulation, condensing inside the wall. This in turn causes rotting and decay. The insulation gets wet, making it useless. Outside paint may peel and blister. This also can happen if the vapor barrier is installed on the wrong side of the insulation.

The vapor barrier should always be placed on the room side of the insulation. It should be properly installed with the joints lapped and securely fastened to the building studs, or bracing. All tears should be sealed with tape. Openings around light fixtures and plumbing pipes should be sealed.

Using vapor barriers, installed correctly, makes it possible to construct tightly insulated houses without fear of condensation in the walls. The vapor barrier makes the inner surface non-porous. The warm moist air does not penetrate the walls. Vapor barriers should always be installed in the walls and floors. They may also be installed in the ceiling. If they are installed in the ceiling, ventilation of the attic is still needed. In all cases, the vapor barrier must be installed on the room side. There are three types of vapor barriers available. They are foil, asphalt-coated paper and polyethlene sheets.

There are four kinds of vents recommended to control water vapor. They are gable vents, ridge and eave vents, roof vents, and foundation vents. Usually, gable vents do an adequate job when there is enough free vent area. If there is a vapor barrier in the ceiling, the free vent area should be 3 square feet for every 900 square feet of attic. If there is not a vapor barrier, the vent area should be 6 square feet for every 900 square feet of attic. There should be at least two vents. Air should flow in one and out the other. Vents should be kept open year round.

Ridge and eave vents are excellent for use at the top of the roof. The top of the roof is where the pressure is greatest. The eave vent provides cross ventilation. Be sure that the ceiling insulation does not block any of the eave vents.

Roof vents help provide good ventilation. They work particularly well in combination with eave venting. Roof vents should be placed high on the roof.

A house with a crawl space needs foundation vents. First of all, there needs to be a moisture seal placed on the ground in the crawl space. This should be a polyethylene ground cover 4 mil thick or use a 55-pound roll roofing for the cover. Ground cover should be lapped 4-6 inches. Sealing is not necessary. The ground cover should be turned up along the foundation walls 4-6 inches. There should be one sq. ft. of vent per 1500 square feet of crawl space. A minimum of two vents is required. They should be placed so that the air flows in one and out the other. When there is no moisture barrier, there should be one square foot of vent per 150 square feet of crawl space. There should also be at least four vents.

Foundation vents should remain open all year.

Besides moisture control, the air flow should also be controlled. Both are necessary to help reduce energy and money used for energy. In a house, there are many areas for air to leak in or heat to leak out. Breaks and cracks in the siding and roofing allow air in. Rain (water) damage can occur. The painted surfaces should be sound. The paint should not be cracking or peeling.

Caulking needs to be tight around windows and door frames. Caulking also needs to be done around chimneys and along the siding joints. Masonry areas should be kept in good repair. Fill in small chinks and cracks with mortar. For major jobs contact a professional.

All doors and windows should be kept repaired. There should be no cracked or broken panes. Make sure they close tightly. Storm-doors and storm windows should also fit tightly. Thermal doors and windows slow down the heat from escaping to the outside. Thermal doors and windows are two layers of material enclosing a vacuum. This vacuum acts as insulation. Any other openings for mail or animal entrances should close tightly. They should also be caulked around the frames.

Gaps around outside doors and windows are a major area of energy loss. Weather stripping will help stop this loss. Flexible, clay-like weather stripping is useful around fixed windows and storm windows. Apply by pressing into cracks and corners, sealing leaks around the frames and joints. There are several weather-stripping kits available for use around doors and windows. These kits include

felt, wood and rubber, metal and rubber, and some may be nailed or stapled while others are self-adhering. Press weather stripping lightly around door or window. Nail or press to the frame. Always start at the top, then the bottom with the sides last.

These are just some things the consumer can do to combat energy loss. The consumer should also consider insulation, the right form of energy and other points discussed in other units.

WEATHERIZING A STRUCTURE

ASSIGNMENT SHEET 1

Weatherizing Needs of Housing

Using the following as a guide check out those areas of a house that needs weatherization.

Suggestion: Use either own home or find a cooperating real estate agent.

List areas according to the following:

1. Areas needing caulking: walls, floor, ceiling tile, cabinet joints, etc.

2. Areas needing weather-stripping:

3. Does structure have storm doors? If yes, what kind are they?

4. Does structure have storm windows?

5. If answer to #4 is no, what measures are taken to protect this area against loss of heat during winter months?

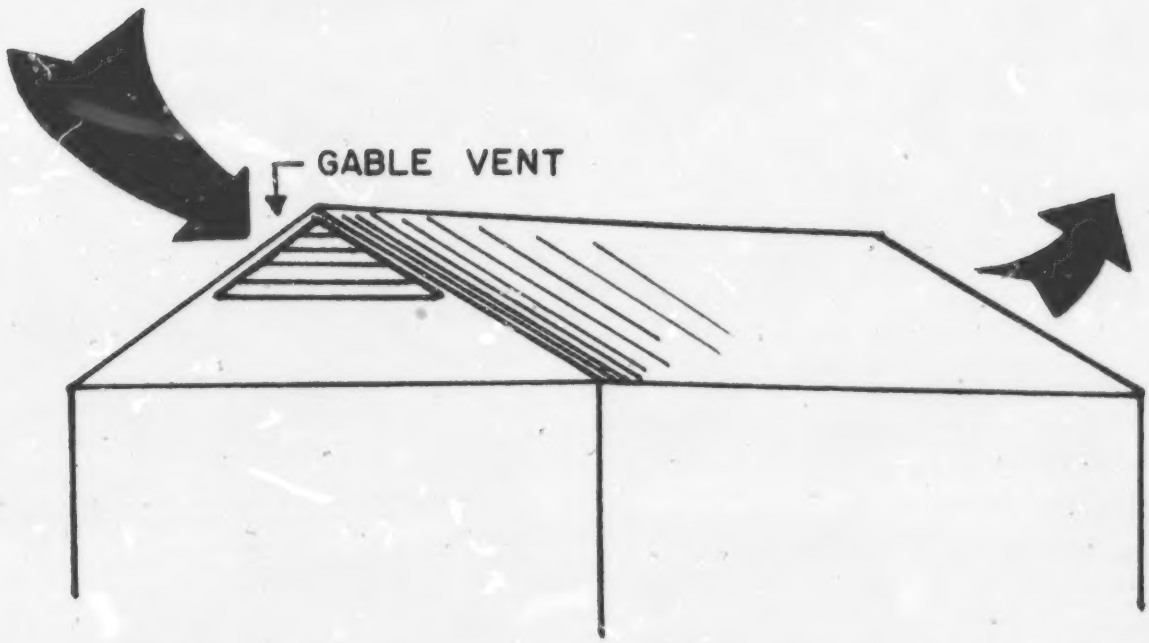
6. What allowances are made for ventilation in the structure?

7. Does the structure have vapor barriers? If yes, describe them.

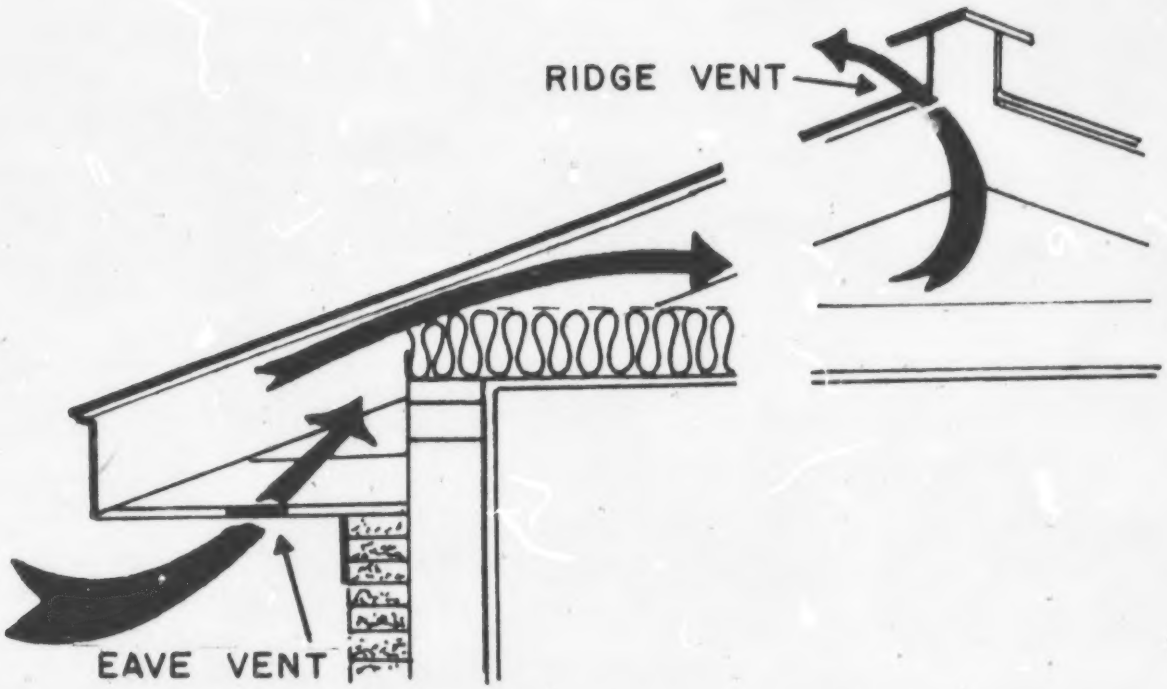
8. Can you detect any evidence of excess moisture in the structure? If answer is yes, list them below.

9. During winter months is there evidence of lack of moisture? If so, what are they?

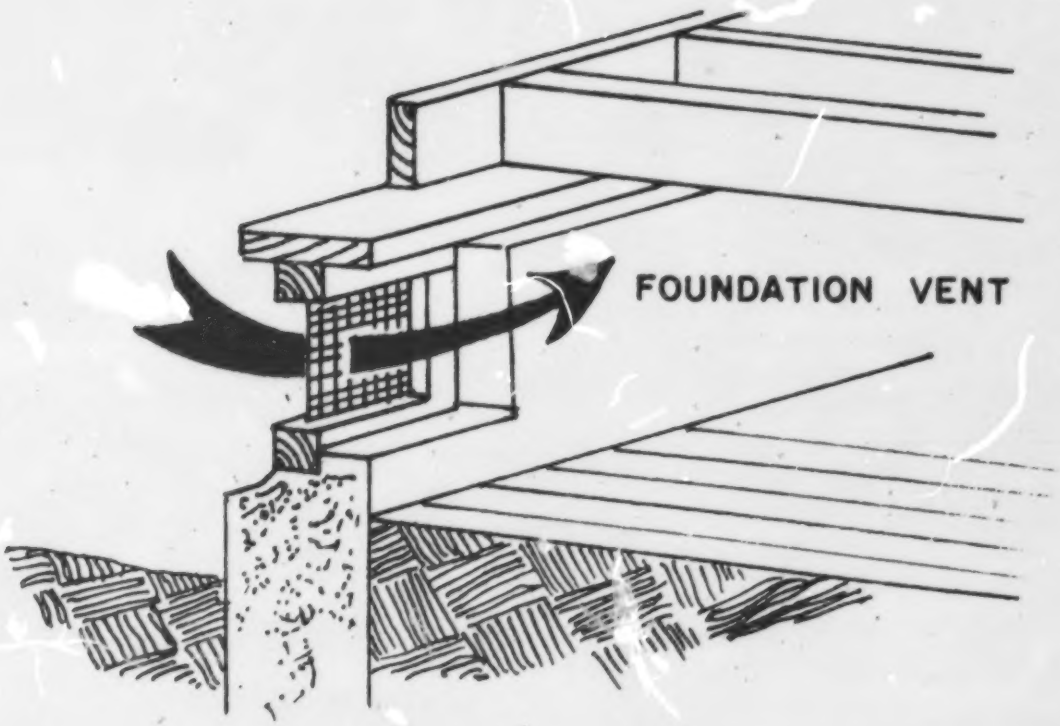
GABLE VENTS



RIDGE AND EAVE VENTS



FOUNDATION VENTS



APPLYING VAPOR BARRIER

APPLYING WEATHER STRIPPING

APPLYING CAULKING

WEATHERIZING A STRUCTURE

UNIT TEST

I. Indicate correct response by circling "T" for true and "F" for false.

T F 1. Relative humidity may be considered as the amount of moisture in the air compared to all the moisture the air is capable of holding at the same temperature.

T F 2. Environmental problems can occur when there is too much or too little moisture in the air.

T F 3. Tub baths add more moisture to the air than do showers.

T F 4. Automatic washers release relatively small amounts of moisture into the air.

T F 5. Algae found growing on roofs indicates damage to the roof itself.

T F 6. Lack of proper ventilation is often a cause to paint peeling or blistering.

T F 7. Presence of fungus or mildew indicates lack of moisture in the environment.

T F 8. Too little moisture in the air of a structure can damage furniture.

T F 9. Body changes such as dryness of eyelids, lips and nasal membranes are related to excess of moisture in environment.

T F 10. Installing storm doors and windows will not affect condensation of moisture on windows.

II. Match the term to the proper definition by placing the adequate response in the space provided.

_____11.	Thin strips of metal, felt or wood used to cover joint between door, window sash etc. to keep out cold air or rain	A. Humidistat
_____12.	Windows composed of 2 layers of glass enclosing a vacuum as insulator	B. Thermal window
_____13.	Substance used to seal	C. Ventilation
_____14.	Reduction of water into vapor form to liquid state	D. Vapor barrier
_____15.	System by which air flow and circulation is achieved	E. Sealant
_____16.	Door composed of two layers of building material enclosing an insulation core	F. Condensation
_____17.	Control device for maintaining relative humidity	G. Relative humidity
_____18.	Filler used to stop up window frame cracks	H. Thermal door
_____19.	Shield used in structures to keep moist warm air inside away from cold outer walls	I. Caulking
_____20.	Amount of moisture in the air as compared with the maximum amount that the air could contain at the same temperature	J. Weather-stripping
		K. Absolute humidity

III. Fill in the blank spaces to complete the statement.

21-22. The principle behind vapor barriers is that water vapor, like heat moves from areas of _____ concentration to areas of _____concentration.

22-23. Water vapor encountering cold surfaces _____ into _____ _____.

24. Water droplets forming inside insulated walls cause insulation to become _____.

25-26-27. There are usually three types of vapor barriers commonly installed in structures. They are _____, _____, and _____.

28. Vapor barriers are placed on the _____ side of walls and floors.

29. The placement of vapor barriers is to protect insulation against _____ in winter.

30. Care must be exercised in applying vapor barriers so as not to _____ it.

IV. 31. Why should we keep insulation from becoming wet?

V. 32. State four points to keep in mind in control of air flow.

1.

2.

3.

4.

VI. 33. Why is a good paint job an important factor of structure weatherizing?

VII. 34. Describe how to apply weather-stripping to storm windows.

VIII. 35. Suppose you do not have the money for installing permanent storm windows. Describe the temporary measures you can take to weatherize fixed windows?

WEATHERIZING A STRUCTURE

ANSWERS TO UNIT TEST

I. 1. T
2. T
3. F
4. T
5. F
6. T
7. F
8. T
9. F
10. F

II. 11. J
12. B
13. E
14. F
15. C
16. H
17. A
18. I
19. D
20. G

III. 21-22. high, low

22-23. condenses, water droplets

24. wet

25-26-27. polyethylene sheets, asphalt-coated paper, foil

28. heated or in side or room

29. condensation

30. tear

IV. 31. Dry insulation will not conduct heat. Wet insulation will conduct heat out to the cold, thus loosing its ability to insulate.

V. 32. Points to keep in mind

1. Siding and roofing
    a. Breaks and cracks allow air in
    b. Increased rain damage can occur
2. Caulking needs to be tight
    a. Around windows
    b. Door frames
    c. Siding joints
    d. Chimneys
3. Cellar doors and windows
    a. Should be kept repaired
    b. No broken panes
    c. Doors must close tightly
4. Masonry areas
    a. Repairs done with mortar
    b. Fill small chinks and cracks
    c. Professional services needed for major jobs
5. Painted surfaces on structures should be sound
    a. Paint seals cracks not noticeable
6. Miscellaneous openings
    a. Mail chutes and animal entrances
    b. Openings should close tightly
    c. Caulking applied around frames

VI. 33. A good paint job on a structure is important as a reduction of air filtration because tiny cracks allow air to enter the structure. Tightly painted surfaces fill cracks and these prevent air filtration.

VII. 34. Weather-stripping -- Gaps around outside doors and windows can be significant energy loss

1. Fixed and storm windows

a. Use flexible, clay-like weather-stripping

b. Apply by pressing into cracks and corners

c. Useful for sealing leaks around frames and joints

2. Doors and opening windows

a. Weather-stripping kits available

(1) felt

(2) wood and rubber

(3) metal and rubber

(4) self-adhering

b. Press weather-stripping lightly around door (or window sash)

c. Nail or press to frames

d. Order of progression

(1) top first

(2) bottom

(3) sides

VIII. 35. Temporary storm shielding provided by plastic sheets

a. Use heavy duty transparent plastic sheets

b. Apply to outside of window facing.

c. Attach with wood strips tacked every six inches.

d. Attach top first, then pull tight to bottom, sides last (Assignment Sheet #1)